

# Trends in Israeli Tank Development

by Lieutenant Colonel David Eshel, IDF (Ret'd)

Israel is a country which is still constantly at war. According to General Israel Tal, there is not a single day when a tank does not fire somewhere in anger, a quite unique situation. In fact, over nearly fifty years of conflict in tank fighting under ultra-modern combat conditions, Israeli tankers have survived to gather combat experience second to none, although most are not professional soldiers. Such knowledge cannot be gained better in any other way, even with the kind of sophisticated computer simulations most armies now use to train under near-realistic conditions. But, as experience shows, nothing can replace real combat. When the chips are down, those who have it under their belts usually survive to live for another day, provided of course, that luck is on their side.

According to carefully collected statistics, some 32,000 tanks fought each other in the Arab-Israeli wars. This is an incredible number, surpassing anything in former conflicts. Over the years, some 4,300 tanks were knocked out by fire. In the Yom Kippur War of October 1973, more than 7,000 tanks fought in some of the most vicious combat action since Kursk, in summer 1943. Yet, during the first Arab-Israeli war in 1948, only 16 obsolete tanks were in action.

Thus, although much has changed over a short period of less than fifty years in this region, the arms race goes on relentlessly, with each side aiming to improve not only its arsenal, but also to develop sophistication in soldier training so as to gain superiority on the future battlefield. It is here that Israel is making most of its efforts to retain its edge over its opponents.

It begins by carefully selecting tank crew candidates and training the basics in realistic training programs. Gunnery has, over the years, become top priority

in Israeli tank crews. Israeli tankers, using their high-tech equipment with top efficiency, perform with superb results on the battlefield and ranges; they are second to none among professional gunners in foreign armies. One must remember that nearly all Israeli tank crewmen are either youngsters under 20 serving three years compulsory service or reservists. But most have at least some combat experience in sustained low-intensity conflicts. Even now, as the Middle East peace process seems to gain momentum, Israel is constantly on full alert to any possible changes that might turn the political tables in this turbulent region. The entire nation is geared to the national security effort, with over 20 percent of the nation involved in security matters in one way or another, be it in active service, industry, or reserves. It is a heavy burden, but a compulsory price that a small nation like Israel — surrounded by hostile elements — must bear to survive.

Two main elements still dominate Israel's deterrence. They are airpower, using highly sophisticated weapon systems, and high alert, fast-moving armored forces, working with a well balanced combined arms combat team. These are still the only viable tools to safeguard Israel's strategic aims under acceptable conditions and with minimum loss rates, the latter a dominant consideration given Israel's small population.

To conserve human lives in combat is one of Israel's top priorities, and has been since the creation of the Jewish State in 1948. Following a high loss rate during the first days of tank combat in the 1973 War, Israeli tank designers have invested relentless efforts to improve survival under the most stringent combat conditions. Realistic data gathered by countless battle experiences became invaluable. Top experts carefully examined each battle casualty.

Knocked-out tanks, which mostly remained in Israeli territory, were subjected to close scrutiny and rigorous high-tech analysis. The information thus gleaned by thousands of hours of field work was stored into a computerized information bank, which became invaluable during the decision-making process that shaped the Merkava project. It remains one of the most ambitious tank designs ever attempted in terms of crew survivability. The massive amount of ballistic data compiled by the Israeli experts provided, for the first time in military history, a unique opportunity to achieve realistic design parameters for safety and combat efficiency. General Tal and his highly skilled team became leading authorities, their experience in modern tank design going far beyond the borders of their realm. In fact, American experts trying to realistically assess the results of the 100 hours of ground combat in Kuwait and Iraq in 1991 consulted Israeli tank experts on their assessment methods, which made their own field work much more effective. But while large numbers of tanks were destroyed by highly sophisticated weaponry during the Gulf War, the results gleaned were of mostly limited value. Most of the combat actions were one-sided, and the real effect of hits by the friendly fire that destroyed a number of tanks was insufficient to draw wide-ranging technical conclusions. While the real capability of the ultra-modern Russian 125-mm tank gun can only be estimated, as only single guns fired with effect at tactical range, General Tal's crew of expert analysts have at their disposal ample information from analysis of countless wrecks destroyed or damaged by a large variety of ATGWs, high-velocity tanks guns of all calibers, and ammunition of all kinds.

A lot has been learned since the days of the Yom Kippur War in 1973. One of the first efforts made by Israeli de-

signers was to find a way to defeat the lethal chemical energy (HEAT) warheads of shoulder-fired antitank weapons and the notorious Russian SAGGER missiles. At the time, the SAGGERS seemed to dominate the battlefield in the Sinai during the first few days of the war. Later, it was clear that the wire-guided missile was not as deadly as many thought at the time, yet it still represented a considerable threat to conventionally armored tanks of that period. Only a few years later, Israeli technicians found a remarkably simple solution — explosive reactive armor — that was to save the lives of many Israeli tank crewmen in the 1982 Lebanon war. Israeli M-60 tanks received an add-on BLAZER suite of reactive armor that provided highly effective protection against the close-in fired RPG and the SAGGER. Losses dropped dramatically. BLAZER came as a complete surprise and was soon copied by other armies, including the Russians, who used it extensively in Afghanistan to survive their own, hitherto lethal weapons! It was only through ill-luck that Russian experts were able to lay their hands on one of those BLAZER-fitted Pattons, abandoned by its Israeli crew, and learn the secret, which allowed them to copy the system.

The Merkava Mark I model also faced its first combat test in the Lebanon War in 1982. It performed with astonishing results under the most stringent combat conditions. Its spaced armor provided excellent survivability, even during close-in urban fighting, where engagements were at near-zero range, and where AT teams fired on tanks from upper floors in buildings along narrow streets. Although some 50 Merkava Mk1s were hit by various weapons at different ranges, only nine crew members were killed, mostly those working with open hatches. Surprisingly, of the 50-odd crewmembers wounded in Merkavas, none were burned! In any other type of tank, far more burn injuries could be expected under the same conditions.

No wonder that Merkava battalions became the dream assignment of every tank crew in the Israeli armor corps! Very little detail of ballistical data on Merkava is unclassified, but it is known that not one Merkava was a total loss in Lebanon, and all were restored to active service, including one tank that was hit by no less than 20 rounds of antitank fire. This is a remarkable feat achieved by Tal's design

## Merkava Mk3, with Modular Armor



Above, General Tal, center, with two members of his staff in front of a new Merkava Mk3, with modular armor suite. The bolts that anchor the armor pack can be seen on the front slope.

At left, a closeup of the modular armor sections that protect the front and sides of the Merkava turret.

Photos by the author

team, and a real morale booster if ever there was one.

Since 1982, the Merkava received two basic modifications and one complete alteration which amounted to a new model of AFV. The Merkava Mk2, the immediate result of the Lebanon experience, included an improved survival kit. But the Merkava Mk3, which currently makes up the majority of tanks in the active service force, is a totally new design. Although quite similar in shape, it embodies a new, ultra-modern, modular armor concept, and integrates a new, powerful 120-mm smooth-bore, high-velocity gun firing a set of indigenous developed ammunition. But the Mk3's most impressive asset is its new armor suite, a near-revolutionary design of modular cast steel armor designed especially for this model by Tal's experts. This unique approach to armor protection makes the Merkava highly flexible. Instead of equipping the tank with a fixed set of armor that cannot be exchanged over the life span of the tank, the modular armor can be exchanged for new de-

signs, if and when new armor technologies emerge. Using modular components also makes it easy to replace damaged parts whenever the need arises, even by crews working under field conditions. Since this modular approach uses parts that are bolted on, instead of welded, an entire armored suit can be removed and fitted at will. Aside from being highly cost-effective, this method allows a force to reduce the weight of the vehicle for air transport, an inherent strategic mobility advantage. Currently, following the demise of the Cold War period, most Western armies face the challenge of both rapid strategic and tactical long-range movements. In most cases, future out-of-area engagements will have to cope with contingencies which may well include threats from modern armored forces, even by hostile elements of the Third World. This threat will have to be countered by friendly armored elements. Under present circumstances, it seems highly questionable that heavy or even medium tanks can be transported by existing or even future air assets to provide substantial



A heavy armored personnel carrier, based on a captured T-55 chassis. The turret has been removed, the engine compartment has been redesigned, and a hatch has been added to the rear for troop access. Other obsolete tanks have been converted to engineer vehicles.

firepower for engaged ground forces in distant areas. While the problem of firepower can be solved by low-caliber high-pressure tank guns or even future ammunition technologies, the problem of armor protection may well persist until a complete breakthrough is made in armor metallurgy. Relatively light-weight tanks with high-powered guns can improve, if not solve, the inter-theater mobility problem, but it is highly doubtful those tanks will be able to survive a close-in battle with enemy medium tanks at acceptable loss rates to their crews. A workable solution could be the addition of modular armor to upgrade lighter tanks AFTER they have landed at their destinations by air, while the add-on armor packs follow separately by air or by pre-positioned sea assets soon after. A near-revolution in superior protection can be achieved with cost effective and logistically flexible means without loss of maneuverability in the field. While current modular armor is entirely passive in its nature, future technologies could envision active armor packs that could well revolutionize armor protection, enhancing the overall protection of the tank from all directions, and solving the problem of TOP ATTACK, which remains one of the greatest vulnerabilities in most modern tanks today.

One of the Israeli armored force's most precious assets is the close cooperation between designers of Tal's expert team and the men in the field who depend on his solutions for their virtual survival in combat.

Most armies live on "Red Tape," which is a natural part of any bureaucracy, but General Tal, who is a soldier's general, has managed to circumvent this phenomena by establishing a direct

link between his team and the tankers in the field. The result is a unique and remarkable process of decision-making which has already come up with several modifications which are the immediate outcome of tank crews reporting on the performance of their weapon systems in combat. The Merkava project is a constantly changing process. With two major upgradings, a large number of improvisations have been included in older models at low cost and carried out in the field by specialist crews at battalion level. These shortcuts have already resulted in lives saved. Tank crews are highly appreciative as a result, which encourages further cooperation at all levels. Thus, General Tal and his team try to remain one step ahead, a constant challenge which has no equal anywhere. In Lebanon, a savage war of attrition is in process daily. The Shiite fanatics use every conceivable weapon to combat Israeli troops day and night. Tanks, and especially the Merkavas, are the cornerstones of this fighting.

Survivability is the order of the day, with Israeli forces facing constant threats from well-placed ambushes and demolition charges cunningly situated on narrow tracks and mountain roads. The Merkava has demonstrated remarkable adaptivity to this type of warfare. Its superior armor protection has withstood most ground attacks from different ranges. Scores of antitank rounds, some of them advanced ATGWs, failed to penetrate, even when fired in salvos. On the other hand, Israeli gunners have managed to destroy Hezbollah rocket launchers by direct fire as the missiles were still in-flight! Accurate tank gunnery more than once made the difference between life and death.

Tal's expert team has done more than design tanks. The fighting in Lebanon, some of which is done under most difficult conditions, calls for some unique solutions to enhance survival. Older tanks, like the M-60, have been upgraded with modular armor. Armored personnel carriers, such as the M113, have been given advanced armor protection against ATGWs, and now sustain most attacks. Obsolete tanks, such as the Centurion and captured Russian T-55s and T-62s, have been redesigned into a variety of APCs, armored engineer vehicles, and especially up-armored carriers capable of withstanding large demolition charges which would have totally destroyed lighter armored vehicles.

These trends in Israeli armored designs will undoubtedly continue, and some future breakthrough in tank design can certainly be expected over the next years, as the need will remain top priority. Israel still very much needs its Armor Corps, and the Corps needs the best tools to do its job.

Lieutenant Colonel David Eshel was born in Dresden, Germany in 1928, and emigrated to Palestine in 1938. After serving for a short spell with the British forces after WWII, he became one of the founding members of the Israeli Armoured Corps in 1948 and served as a career officer with the Israel Defence Forces for 26 years.

Educated at the French Cavalry School at Saumur, he later held various command and staff assignments, and fought in all the Arab-Israeli wars up to and including 1973, when he served as Chief of Signals of the Armoured Corps. His last assignment was lecturer on tactics at the IDF Command and Staff College. He studied history at Tel Aviv University and served for 12 years as editor of an Israeli-German based defense journal. He now acts as a freelance journalist and defence analyst for several leading American and European military journals.